Near-infrared measurement of cerebral hemodynamics during parabolic flight

Problem Statement

- NASA has a limited ability to assess brain physiology during spaceflight. This is of particular concern given the recent visual impairments thought to be related to intracranial hypertension (VIIP).
- Our NINscan technology can measure cerebral oxygenation and blood volume—including venous congestion—but needs operational testing to bring it from TRL 4 to TRL 6.
- Potential users: flight surgeons, astronauts, first responders

Technology Development Team

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Proposed Flight Experiment

Experiment Readiness:

- By July 1, 2013

Test Vehicles:

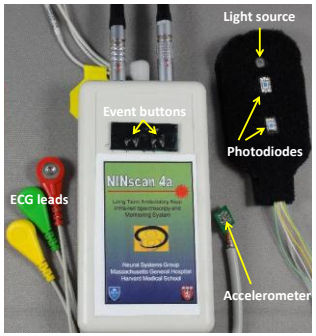
- Parabolic aircraft

Previous Test Environments:

- A previous NINscan prototype system (ver 2a) was tested on a Zero-G flight in June 2009 (photo)
- NINscan 2a was also used on 3 ascents of Mt. Kilimanjaro, testing for robustness, user-friendliness, and cerebral alterations in hypoxia.
- The current prototype (NINscan 4a) is based on ver. 2a, but has not been previously flight tested.
- No previous requests through Flight Opportunities.

Test Apparatus Description:

- NINscan systems only require inserting AA batteries for operation. Buttons on the face of the box can be used to synchronize with external events.
- Valsalva/Mueller tests require a pressure gauge and “straw”. Cognitive testing requires a battery powered laptop.



Technology Maturation

- Current: NINscan 4a has not been tested outside laboratory environments, so it is currently TRL 4.
- Needs: Testing for robustness, ease-of-use, and sensitivity to brain hemodynamics in altered gravity (e.g. parabolic flight) are required to achieve TRL 6.
- Timeline: TRL 6 by late 2014, to coincide with proposed flight experiments t o reach TRL 7.

Objective of Proposed Experiment

- Objective: Test the sensitivity of NINscan 4a to various changes in cerebral hemodynamics caused by varying-gravity fields.
- Data: Data on cerebral fluid shifts, hemodynamic responses to vascular pressurization (Valsalva/Mueller maneuvers) and brain function will be used to assess NINscan 4a sensitivity to brain tissue in a spaceflight-analog environment.

TA06: Human Health, Life Support and Habitation Systems